INFORMATION PROCESSING FOR REMOTE SENSING

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EDITOR

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PREFACE

The final objective in most remote sensing activities is to extract certain desired information from the remotely sensed imagery and/or signals. With major advances in the development of remote sensing devices in recent years, the need for advanced information processing techniques is quite evident. Progress on information processing must at least be able to keep up with increased data and increased demand for more accurate and detailed information from the data. Although the publication of information processing for remote sensing results has appeared in a number of journal and conference papers, a single volume that reports the latest advances in the field is much needed and this book is intended to serve this purpose.

I am honored to have the leading experts in the field to report in this book their important work in aspects of information processing in remote sensing. The book starts with three chapters on topics of general interest. Chapter 1 by Prof. Landgrebe provides an outstanding introduction of information extraction from remote sensing data. As a leading researcher in the field, Prof. Landgrebe's work has had profound influence in the field for well over 30 years. Chapter 2 provides some literature study of the field based largely on the publications of the IEEE Trans. On Geoscience and Remote Sensing, which is one of the leading publications in remote sensing. Chapter 3 is concerned with the forward modeling in data analysis which is of fundamental importance to information processing.

The other chapters should also have general interest. However a specific topic heading is more descriptive of the nature of the chapters though some chapters may be suitable under more than one topic headings. For the pattern recognition topic, Chapter 4 is concerned with the linear and nonlinear mixed pixel classification, a problem which seems to be quite unique to the remote sensing. Chapter 5 deals with an adaptive Bayesian classifier for the detection of tactical targets with unknown spectral signatures and cluttered backgrounds in multispectral imagery. For SAR imagery, Chapter 6 and Chapter 7 provide an excellent overview of filtering, classification, edge detection and segmentation. Additional discussion on pixel segmentation is in Chapter 8. On the topic of parameter extraction, Chapter 9 presents a multiparameter weather radar analysis using wavelet transform.

One area of major development in recent years is the use of neural network and fuzzy logic methods. This progress is covered by five excellent chapters on different aspects of neural networks in remote sensing. Chapter 10 provides a discussion of neural networks as non-linear approximators in the ocean remote sensing area. Chapter 11 presents the use fuzzy ARTMAP in detecting forest change. Chapter 12 employs a supervised classification methods based on the self-organizing neural network and a k-nearest neighbor method, for land cover classification using SAR data and LANDSAT-TM data. Chapter 13 demonstrates the capability of dynamic learning neural networks and the fuzzy version to image classification and parameter retrieval. Chapter 14 presents an algorithm to derive an ice chart from a SAR image by using the Pulse-Coupled Neural Networks. The topic of change detection is particularly important to remote sensing as much useful information is derived from detected changes. Chapter 15 plays a unique role to cover this topic well.

Another important development on information processing is the knowledge-based method and data fusion as presented by three excellent chapters. The knowledge-based method refers to the use of artificial intelligence techniques, as represented by Chapter 16. Chapter 17 provides an introduction to the increasingly popular subject of multisensor data fusion using neural networks. Chapter 18 presents approximate reasoning techniques suitable for remote sensing problems and a strategy based on hybrid reasoning and multistrategy learning for the classification of multisource remote sensing images. The progress in image processing algorithms was largely motivated by the need in remote sensing. Chapters 19, 20, and 21 present three different aspects of the image processing algorithm development which provide excellent coverage on the topic. Image compression has always an important area in information processing. The topic is particularly important now as new sensors acquire a very large amount of data which often have to be compressed for image transmission and storage. Chapters 22 and 23 deal with lossy data compression for hyperspectral imagery and other imagery respectively. Software development plays a key role in information processing. Development of intelligent system technologies as described in Chapter 24 thus represents an effort to realize a software system that has a number of capabilities which can be considered as intelligent. Finally Chapter 25 is on a topic of discrimination of buried objects, which attracts increasing interest in remote sensing community.

If we examine the evolution of the information processing field in the last twenty years, we may notice that the fundamental approaches remain almost the same while new techniques such as neural networks and wavelet transforms are added to the list of information extraction approaches. Thus I firmly believe that the chapters presented in the book has a long lasting value inspite of the changing trends on information processing, increased sophistication in sensors, and improved platforms and data acquisition systems. There is no doubt that the book will continue to be useful to both information processing and remote sensing communities as we enter the new century.

Finally I would like to thank all contributors for their important contribution to the book and their cooperation to meet the manuscript deadlines. Thanks also go to Steven Patt, World Scientific Publishing Co., in-house editor of this book, for his efficient effort to make a timely publication of the book possible.

C. H. Chen
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